IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appln No:	10/594,157
Applicant:	Ian Alastair KIRK
Filed:	February 26, 2006
For :	Downhole apparatus for mobilising drill cuttings
Art Unit:	3676
Examiner:	FULLER, Robert E.
Attorney Docket:	ZQ120/07001

Commissioner of Patents and Trademarks
PO Box 1450
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DECLARATION UNDER 37 C.F.R. 1.132

S I R:

I, Paul Gwyn Williams, of Aberdeen, United Kingdom, hereby declare and state as follows:

1) I am a qualified drilling engineer. My qualifications and experience are set out in my previous declaration dated June 2, 2011. My qualifications and experience have not changed since then.

2) I have read and understood the response filed June 8, 2011, and the Office Action dated June 21, 2011, as well as the earlier papers issued on the present application, referred to in my previous declaration, including the cited documents of DeBray (US 6,032,748), Buttolph (US 2,589,534) Thomson (US 4,275,935) and Krueger (US 5, 803,193).

3) I note that in the office action dated June 21, 2011, the examiner has continued to reject the claims of the present application on the basis of Buttolph and DeBray, and has indicated in the "Response to arguments" section beginning at page 7 of the office action that the arguments in my previous declaration are not persuasive

because the newly cited documents of Thomson and Krueger are inconsistent with the main arguments previously presented that:

a) "Buttolph's device would no longer be able to withstand a jarring force if it were modified to be constructed as a clamp in accordance with the teachings of DeBray...;
b) "...Buttolph's device is subjected to much higher loads than the device of DeBray et al since DeBray's stabiliser is attached to a drill collar rather than a standard drill tubular"

4) I note that the examiner has incorrectly referred in the second paragraph above to DeBray's device being attached to a "drill collar". DeBray's device is not attached to a drill collar. DeBray does not mention drill collars and only relates to drill pipe. It is Buttolph's device that is attached to a drill collar. I understand that the examiner intended here to refer to Buttolph being attached to the drill collar rather than DeBray in the above second paragraph.

5) The examiner cites Thomson and Krueger as evidence that the skilled person would have found it reasonable to modify the stabilizer of Buttolph to be clamped to the drill collar and still expect it (the modified Buttolph design with the clamp) to be able to withstand the loads experienced during normal drilling and even during jarring.

6) Thomson is attached to the drill collar but has a very sturdy attachment that precludes movement of the Thomson sleeve. Krueger's drill pipe protector is not attached to the drill collar and comprises a simple sleeve that rotates around the outer surface of a length of drill pipe and slides axially up and down it. Neither Krueger nor Thomson has any relatively moving parts, nor do they interact with any other components on their outer surfaces.

7) While Thomson and Krueger show that plain sleeves can be clamped onto the drill collar if given enough structural support (like the multitude of bolts fixing the Thomson sleeve) the relevant question is what would happen to the particular

design of the Buttolph device if the sleeve shown in the Buttolph device were to be clamped onto the drill collar instead of being a solid cylinder as is taught by Buttolph, and would a person of ordinary skill in the art of drilling oil and gas wells (most likely a drilling engineer like me) make such a modification to the particular design described by Buttolph. This was the subject of my earlier declarations.

8) I would certainly not make the modification to Buttolph's design to divide the sleeve 13 and clamp it onto the Buttolph body 10, and I believe that no other drilling engineer would make such a modification. Modifying the Buttolph device to divide the sleeve 13 and clamp it around the body 10 between the collars 11, 12 would mean that the axial split portions would behave differently from the rest of the sleeve when the sleeve 13 was thrust upwardly against the upper collar 11. This differential behaviour might be acceptable in simpler designs like the Thomson and Krueger devices which do not need to interact with any other components on their outer surfaces, and which do not have any moving parts, but the considerations are different for Buttolph. In Buttolph, the outer surface of the sleeve 13 needs to fulfil other functions. For example, the sleeve 13 needs to act as a bearing surface for the inner diameter of the rest 14. The outer diameter of the rest 14 bears against the inner diameter of the wellbore, and free relative rotation and axial translation of the rest 14 on the sleeve 13 is an essential function of the Buttolph device, modified or not. Therefore, whether simple devices without such additional functions like the Thomson and Krueger devices can clamp on to strings is not relevant. What is relevant is whether the particular arrangement of the Buttolph device would be changed in order to make it clamp on to the string, with the expectation that the modified Buttolph device would still be able to perform ALL of its necessary functions. After considering the examiner's comments in the office action dated June 21, 2011, I do not consider that the additional documents of Krueger and Thomson make the combination of DeBray and Buttolph any more likely, and I maintain my view that the skilled person seeking to improve Buttolph would not modify Buttolph to divide the sleeve 13 and clamp it around the body 10 of the drill collar, whether he considered DeBray, Krueger, Thomson or any of the other prior art documents of record in this case.

9) The Buttolph sleeve 13 is designed to be held in axial compression between the two collars 11, 12, and needs to withstand axial thrust forces applied to the sleeve when the blades 26 on the collars 11, 12 ream into the sides of the hole as taught at column 6 line 70 through to column 7 line 14. See also column 5 line 1 to 7. This resistance to axial force is not limited to jarring events, and needs to happen when the well formation needs to be cleared from the area of the Buttolph device during normal drilling. Also, it is clear from column 5 line 36-50 (especially line 49-50) that the sleeve 13 is held *"tightly between the collars 11, 12"* i.e. in an axial direction to add strength to the assembly. The reason for this is that the sharpened leading edges 28 (the examiner has incorrectly referred to these as vanes) on the ends of the blades 26 are supposed to cut into the formation in each direction to clear a passage for the device.

10) For example, as taught in the passage bridging columns 6 and 7 of Buttolph, as drilling advances and the sleeve 13 is moving down the well, the sharp edges 208 of the blades 26 at the lower end of the sleeve 13 are intended to be able to cut into the formation. The upper blades 26 are also designed to cut in the opposite direction when the string is being pulled out of the well. In that event the upper blades 26 are intended to cut away collapsing side walls to enable removal of the Buttolph device from the well. Because the sleeve 13 is clamped tightly between the collars 11, 12, as disclosed at column 5 line 50, the sleeve 13 is intended to brace between the collars and resist the axial forces when this up and down cutting action takes place.

11) Deliberately modifying the Buttolph sleeve 13 to divide it axially and allow it to open and close around the drill string as now claimed would significantly affect the behaviour of the modified sleeve 13 when exposed to such thrust forces as described in these passages. Instead of being a solid cylinder with a consistent strength all around the circumference of the cylinder as is actually taught by Buttolph, the modified split sleeve would NOT be consistent in strength all around its circumference. This is an inevitable consequence of making the modification proposed by the examiner rather than just my subjective opinion. The solid part of the sleeve 13 without the split would behave normally with respect to axial force

transmission from one end of the sleeve to the other. However, the modified part of the sleeve with the split would inevitably have a different behaviour under axial force. In particular, the result of axially dividing Buttolph's device would be that the split portion would be weaker than the un-split portion.

12) In particular, dividing the sleeve would have the following consequences:

13) Compression behaviour. The modified sleeve would no longer be safe to compress tightly between the collars 11 and 12 in the manner taught by column 5 lines 36-50 of Buttolph, without the significant risk that the split ends would deform, because the split portion would inevitably not have the same uniform resistance to axial thrust forces as the un-split portion of the sleeve 13. In particular, the split would be likely to deform more during compression than the rest of the sleeve. The only direction for deformation of the ends of the sleeve 13 would be radially outwards (as the inner surface of the sleeve 13 is pressed against the body 10) and so there would be a risk that under high axial forces like the tight compression taught by Buttolph, the two split ends in the modified sleeve 13 would tend to curve open away from the body 10 and away from one another, or at the very least would not transmit the same axial force between the collars 11, 12 as compared with the un-split portions of the sleeve 13. This deformation would cause the split ends to bend out of their initially parallel and straight configurations, into bent configurations curving outwardly from the body 10, and projecting into the space usually occupied by the inner surface of the rest 14. This outward bowing effect on the split ends of the sleeve 13 would probably be most pronounced at the part of the sleeve 13 that was not covered by the rest 14 (see the uncovered lower section of the sleeve 13 in Fig 4).

14) Reaming performance. As a result of dividing the sleeve, the reaming performance of the modified sleeve would be impaired and the modified device might no longer reliably ream or cut into the formation when running into the hole, or when pulling out of the hole as taught in the passage between columns 6 and 7 of Buttolph without the same risk of deformation of the weaker split portion to a greater extent than the stronger un-split portion of the sleeve 13. Therefore, the

split ends would be likely to deform more during cutting and reaming operations than the rest of the sleeve, and so there would be a risk that the axial forces applied to the collars 12 and 11 and transmitted to the sleeve 13 as taught by Buttolph in column 5 lines 1-6 would be likely to cause further deformation or damage to the split ends in the modified sleeve 13, which would tend to deform (e.g. open outward) even more underneath the rest 14 or at the very least would not transmit the same axial force between the collars 11, 12 as the un-split portions of the sleeve 13. This would further remove or reduce the sleeve's axial support for the collars 11, 12, and could also do so asymmetrically as a result of the axial split being on one side, and this in turn would risk misalignment of the collars with one another as a result of the reduced axial support from the split portion of the modified sleeve 13. Such asymmetrical transmission of force through the split sleeve 13 would therefore risk damage or crossing and jamming of the threads between the collars 11, 12 and the body 10.

15) Rotational freedom. In addition to these drawbacks the freedom of the rest 14 to rotate on the modified split sleeve 13 would be affected, because even a small amount of outward buckling or deformation of the split ends of the sleeve 13 on which the rest 14 needs to rotate would cause the modified sleeve 13 to adopt a non-cylindrical configuration, which would prevent or restrict free rotation of the rest 14 on the sleeve 13. This restriction of freedom of the rest 14 to rotate on the sleeve 13 would mean that shear forces and torque acting on the rest 14 (and previously being harmlessly resolved through free rotation of the rest 14 on the sleeve 13) would then be transferred from the suddenly non rotating rest 14 to the weaker split ends of the sleeve 13, which would increase the tendency of the modified split sleeve 13 to deform even more, thereby worsening the damage to the modified sleeve 13 and the collars 11, 12 against which it is braced, and reducing still further the freedom of rotation of the rest 14 on the sleeve 13.

16) Axial translation of the rest 14. The rest 14 would also be affected in its freedom to move axially up and down the sleeve 13 if it were to be buckled due to the split. This would reduce the capacity of the modified device to be jarred loose in stuck holes. Also, as the outwardly buckled sleeve 13 would arrest the axial translation

of the rest 14 at the damaged portion that had bent outwards, the whole of the axial force of jarring that was applied to the rest would be transferred to the already weakened & buckled portion of the sleeve 13, instead of to the end collars 11, 12, which would exacerbate the damage to the already weakened sleeve 13 and lead to further loss of integrity of the modified system.

17) Tolerance. Forming the sleeve as a solid cylinder as is actually taught by Buttolph rather than with a split as proposed by the examiner has the advantage that the inner and outer diameter of the sleeve and the inner diameter of the rest 14 can be very precisely controlled and predicted, so that a solid sleeve 13 can be made to fit tightly over the body 10 with a close tolerance, having an inner diameter that is close to a perfect circle, and with very little uncontrolled relative movement between the body and the sleeve 13. Likewise the rest 14 can be made with a close tolerance between the inner diameter of the rest 14 and the outer diameter of the sleeve 13, allowing again a close fit with little room for uncontrolled relative movement like shaking or rattling in the assembled sub. This is an advantage for the unmodified Buttolph device, because closer tolerances means less vibration and wear as the rest 14 rotates around the (nearly perfectly circular) sleeve 13 in use, and more effective bracing of the rest 14 during axial thrusting of the body 10, when cutting or jarring. Also it means that the tool can be assembled as a whole sub on shore in the factory or on the quayside workshop in relatively benign conditions so that the operator at the rig site needs only to insert the sub into the string, and can be sure that once the sub is made up into the string, the tolerances, freedom of rotation of the rest 14, and axial thresholds of force in different tools on the same string will be the consistent throughout the length of the string.

18) These advantages would ALL be completely lost if the sleeve 13 were to be split and clamped on to the Buttolph body. The clamps would be tightened so that the inner diameter of the modified sleeve 13 would start relatively larger than the OD of the body 10 and would be gradually reduced until the inner surface of the sleeve was compressed against the OD of the body 10. This is the nature of a clamp. This would inevitably lead to a more variable tolerance of the inner diameter of the sleeve 13, because some sleeves would inevitably be tightened more than others

and the outer diameter of the bearing region on which the rest is mounted would therefore also vary, with some rests mounted on tightly fitted sleeves 13, with a large annular space between the rest 14 and the sleeve 13, allowing uncontrolled movement of the rest 14 which could rattle around the sleeve 13, whereas some rests 14 would be fitted onto loosely fitted sleeves 13 with a larger outer diameter when fixed, and therefore a smaller annulus between sleeve 13 and rest 14, so relative movement of the rest 14 on the sleeve 13 could be restricted.

19) Therefore, this one step of splitting the sleeve 13 to permit it to open and close around the body 10 would directly lead to more variability in tolerance for the sleeve and the rest, variation in clamping force for the different devices up and down the string, and variation in rotational freedom of the rest on each of the different sleeves.

20) All of these inevitable effects would make it less attractive for the skilled person to operate the modification. Some devices could be clamped on with relatively loose fixings, whereas some could be over-tightened, as each "clamped–on" variant could easily need to be installed under adverse conditions on an offshore drilling rig, always under time pressure, and possibly by relatively un-skilled deckhand workers who may not have the necessary training or consistency in operation, nor the necessary time under the tight rig operating schedule to make the necessary checks on tolerances etc.

21) Fixing problems. The above tensioning problems for the clamps would also lead to some fixings being more susceptible to loosening in the hole, or being incorrectly tightened on installation. This would lead to the increased risk of lost bolts or other fixings in the hole, and lost sleeves or other parts of the modified assembly that came away from the body 10 when loose fixing bolts fell off.

22) Also, fixing the clamped sleeve 13 in place on the body 10 would require fixing clamps that would need to be applied to the outer surface of the sleeve 13. This is not at all straight forward, because in Buttolph the sleeve 13 needs to allow the rest 14 to rotate on its outer surface, and there are size limitations on the sleeve 13

that are imposed by the wall thickness of the rest 14 and the inner body 10, so the sleeve 13 needs to be relatively thin walled, and needs to have a smooth outer surface for the rest to travel over. The skilled person would not easily adapt the same solutions as are used in DeBray, or Thomson or Krueger, as these devices all use relatively large robust fixings that are easily accessible from outside the sleeve. In all of these devices the clamped on sleeve is the outermost part of the structure, and it doesn't matter if the wall of the sleeve on the DeBray, or Thomson and Krueger systems is bulky or has bolts passing though it tangentially. These sleeve fixings therefore do not translate in any obvious way to the think walled internal Buttolph sleeve. The skilled person could not increase the depth of the walls of the Buttolph sleeve without sacrificing bore size in the body 10 or wall thickness of the rest 14, neither of which would be attractive options.

23) The provision of fixings on the outer surface of the modified axially divided sleeve 13 would also interfere with the ability of the rest 14 to move axially on the sleeve 13, and the fixings would need to be applied in such a way that the rest 14 was able to jar against something other than the fixings when the device was stuck and needed to be jarred free as described in column 7 second paragraph. Obviously jarring the rest 14 axially directly against the fixings holding the clamped sleeve 13 in place would shear them loose, as they would not be adapted for resisting axial shear forces from the rest 14, and so it is not clear at all how the skilled person would fix the clamped on modified sleeve 13 to the body 10 without making the fixings (bolts etc) too susceptible to being ripped off by the rest 14 sliding axially up and down the long axial space between the collars 11, 12 (as described in column 7 second paragraph) or by catching on some ledge in the wellbore when being run in or pulled out of the hole. This would be an additional problem that would need to be solved by the skilled person if he were to make the examiner's proposed modification work. The examiner's objections contain no indication as to how the skilled person would resolve these issues in Buttolph's modified sleeve.

24) The solid cylindrical construction of the present unmodified design of Buttolph sleeve 13 has a uniform outer clearance along its whole outer surface, so that the rest 14 can slide axially for jarring and rotate freely relative to the body 10 (actually

the body rotates relative to the rest, which stays motionless against the side of the wellbore) without any requirement for an external clamping fixture to hold the sleeve 13 in place on the body 10. This elegant advantage of the original Buttolph design would be lost by the proposed modification. Yet another reason why the skilled person would reject this modification.

25) In my previous declarations I discussed the issue of jarring. While jarring is one function of the Buttolph tool that would be adversely affected by the modification to divide and clamp the sleeve, it is not the only function. Therefore, a skilled person tempted to modify the Buttolph sleeve to divide it and clamp it onto the body 10 of the drill collar in Buttolph would need to address the issue of jarring and I do not think that the publications of Thomson and Krueger would assist him with that particular modification to the Buttolph tool, BUT he would also need to overcome the other issues that are not related to jarring. The examiner's objections appear to be focussed on the issue of jarring, and do not appear to address the other issues discussed above, which would cause the skilled person to reject the possible modification of the Buttolph device to clamp the sleeve 13.

26) A typical drilling engineer of ordinary skill in the art would be mindful of his primary responsibility to manage the drilling the operator's well prudently, and would be strongly motivated NOT to change Buttolph's design to change the sleeve 13 so that it opened and closed around the body 10, because the problems outlined above which would result for the modification would <u>increase the risks</u> of using the modified device in the client's well.

27) I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements are made with the knowledge that wilful false

statements and the like are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such wilful false statements may jeopardize the validity of the above-mentioned application or any patent issued thereon.

Date: 20/12/2011 **Signed:** .....

Paul Gwyn Williams

Witnessed by ..... (Witness signature)

DEREK JOHN HARROLD ..... (Print witness name)